

FROGS OF THE GENUS *TAUDACTYLUS* WITH DESCRIPTIONS
OF TWO NEW SPECIES (ANURA: LEPTODACTYLIDAE)

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ABSTRACT

Two new species of *Taudactylus* are described, and the status of *T. diurnus* and *T. acutirostris* are reviewed. The genus *Taudactylus* now contains four species, *T. acutirostris* (Anderson), *T. diurnus* Straughan and Lee, *T. eungellensis* sp. nov., and *T. rheophilus* sp. nov., and ranges along the Great Dividing Range of Queensland. Extension of ranges of *T. acutirostris* and *T. diurnus* are mentioned; *T. rheophilus* is found only on Mt Lewis, N. Queensland and *T. eungellensis* at Eungella and Finch Hatton, central eastern Queensland. *T. rheophilus* is characterized by the broad head, and vertical snout in profile, and *T. eungellensis* differs from *T. diurnus* by the larger size and the male call. It is suggested that this genus was derived in the Tertiary, from *Crinia*-like ancestors, which adapt to mountain rainforest habitat. This genus now survives as a relict in mountain rainforest pockets along the Great Dividing Range of Queensland.

In 1966, I. R. Straughan and A. K. Lee erected a new genus *Taudactylus* for a moderate sized leptodactylid frog with T-shaped terminal phalanges. *Crinia acutirostris* also has the T-shaped terminal phalanges and toes, hence it was placed in the genus *Taudactylus* (Straughan and Main, 1966). Lynch (1971) redefined the genus *Taudactylus* and presented a series of osteological characters, however only the T-shaped terminal phalanges of toes and fingers are diagnostic of this genus; Lynch also synonymized *T. diurnus* Straughan and Lee and *T. acutirostris* (Anderson) without presenting any concrete evidence, hence considered this genus monotypic.

The object of this paper is to describe two new species which belong to the genus *Taudactylus*, to clarify the taxonomic status of *T. acutirostris* and *T. diurnus*, and to present the biology and the distribution of members of this genus.

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MATERIALS AND METHODS

Dissection of the myology was done under a Wild Stereoscopic microscope; dried as well as cleared and stained skeletons were prepared. Measurements were taken with dial calipers with an accuracy of 0.1 mm. Drawings were done by the senior author under a stereo-microscope with the aid of a camera lucida. The following abbreviations were used for adult measurements: SV, snout-vent length; TL, tibial length; HW, head width at broadest part; EN, distance between external nostril and anterior border of eye; IN, straight distance between the two external nostrils. For tadpoles the following abbreviations of measurements were used: ST, snout-tail length; SV, snout-vent length; TAL, tail length measured from tip of tail to anal opening; TH, tail height at broadest portion; BW, body width at broadest section. The following are the abbreviations of Institutions where the specimens are deposited: AM-Australian Museum, FMNH-Field Museum of Natural History, QM-Queensland Museum, WAM-Western Australian Museum, DSL-David S. Liem collection.

SYSTEMATICS

Recently, two species of leptodactylids were collected, one from North Queensland and another from Eungella-Finch Hatton area, central eastern Queensland. These two specifically distinct forms show great similarities to the genus *Taudactylus*. Many characters shared by these four species are unique among the currently recognized leptodactylids: T-shaped terminal phalanges of digits; discs on tip of digit with longitudinal groove; sharp angular canthus rostralis; and that the M. geniohyoideus medialis ventral to M. geniohyoideus lateralis, lateral to M. sternohyoideus and inserting on distal half of posterior lateral process of hyoid plate. The above characters indicate a close relationship among the four species mentioned and clearly distinguish them as a group from any genus of Australo-papuan leptodactylids. On the basis of these distinctions, these two new species, *T. rheophilus* and *T. eungellensis*, are here referred to the genus *Taudactylus*.

Of 17 characters presented in the description of the new genus *Taudactylus* (Straughan and Lee, 1966) only two are diagnostic of the genus amongst the Australo-papuan leptodactylids, i.e. T-shaped terminal phalanges of digits, and the expansion of the digits distally into a disc. Lynch (1971) listed 33 characters in the diagnostic definition of this genus but only one is restricted to this genus i.e. T-shaped terminal phalanges. Omosternum was reported absent by Lynch (1971), however, after careful examinations the senior author found that it was absent in *Taudactylus diurnus* and *T. eungellensis* only, and present in *T. acutirostris* and *T. rheophilus*. The senior author agrees with Straughan and Lee (1966) that the fronto-parietal fontanelle is absent in *Taudactylus diurnus* contrary to Lynch's (1971) statement but the vomers are minute elongated bones on the median side of the choanae and are present in *T. diurnus* as well as *T. acutirostris* and thus agree with Lynch's, but not with Straughan and Lee's statement. The nasal bones are variable, with moderate size club-shaped nasals moderately separated from each other in *T. diurnus*, and small narrow nasal bones widely separated from each other in *T. acutirostris*, *T. eungellensis* and *T. rheophilus*. All other characters agree with Lynch's (1971) and Straughan and Lee's (1966) descriptions.

In this paper only the above characters and those which are diagnostic of the genus *Taudactylus* are listed in the generic account.

The following measurements were recorded for adult frogs: SV, HW, TL, SL, EN, IN, and the HW/SV, TL/SV, and EN/IN ratios were calculated. Only the SV-length, and HW/SV ratio are useful for differentiating members of the genus *Taudactylus*. For tadpoles the ST, SV, TAL, TH, and BE and TAL/ST, TH/TAL, and BW/SV ratios were recorded. Only BW/SV ratio is useful for distinguishing between *T. acutirostris* on one hand and *T. diurnus* and *T. eungellensis* on the other.

Taudactylus Straughan and Lee, 1966

Taudactylus Straughan and Lee, 1966, p. 63 (Type-species by original designation, *Taudactylus diurnus* Straughan and Lee, 1966); Straughan and Main, 1966, p. 11; Lynch, 1971, p. 95.

DIAGNOSIS: This genus could be distinguished from any other Australo-papuan leptodactylid frogs by the following characters: T-shaped terminal phalanges of fingers and toes (Fig. 3D); M. geniohyoideus medialis ventral to geniohyoideus lateralis, lateral to M. sternohyoideus and inserting on distal half of the posterior lateral process of hyoid plate (Fig. 2B); characterised externally by expanded digital discs with a median longitudinal groove dorsally (Fig. 5), sharp canthus rostralis and in some wedge-shaped snout protruding beyond mouth. Tadpoles of *T. diurnus*, *T. eungellensis* and *T. acutirostris* could easily be distinguished from any other Australo-papuan tadpoles by the presence of broadly expanded umbrella-shaped lips forming a sucker mouth, and the presence of lateral line organs on head and body. The labial tooth rows are absent in *T. diurnus* and *T. eungellensis* and present in *T. acutirostris*, with a formula of I, 1/1, I, I(1/4).

CONTENT: Four species: *Taudactylus acutirostris* (Anderson), *Taudactylus diurnus* Straughan and Lee, *Taudactylus eungellensis* sp. nov., and *Taudactylus rheophilus* sp. nov.

DESCRIPTION AND VARIATION: All members of the genus *Taudactylus* are moderate sized frogs, males range 21.0–27.2 mm and females 21.0–35.9 mm in SV-length; TL/SV ratio is 0.435–0.565; HW/SV ratio is 0.288–0.412; EN/SL ratio 0.390–0.658; EN/IN ratio is 0.525–0.773. Snout in profile protrudes beyond upper jaw in *T. acutirostris*, *T. diurnus* and *T. eungellensis* and in dorsal aspect acuminate or blunt (Fig. 4A, B). Loreal region straight, canthus rostralis form a sharp angle in section. Tongue 1.5 to 1.25 longer than wide, free posteriorly. Vomerine teeth absent. Vocal sac and its opening variable in occurrence. Pupil oval and orients horizontally. Tympanum hidden under the skin. Dorso-lateral skin fold and three tubercles arranged in a triangle on the lower back are present in *T. acutirostris* only. Dorsal skin of *T. diurnus* and *T. eungellensis* is coarsely granular with round tubercles whereas *T. acutirostris* is finely granular with longitudinal skin folds. Cloacal opening is directed posteriorly or posteroventrally at mid-level of the thighs.

Nuptial pad variable in appearance and occurrence. Digits unwebbed and distally expanded into discs with a longitudinal groove (Fig. 5). Subarticular tubercle of fingers are variable in occurrence, but the metacarpal and palmar tubercles are always present.

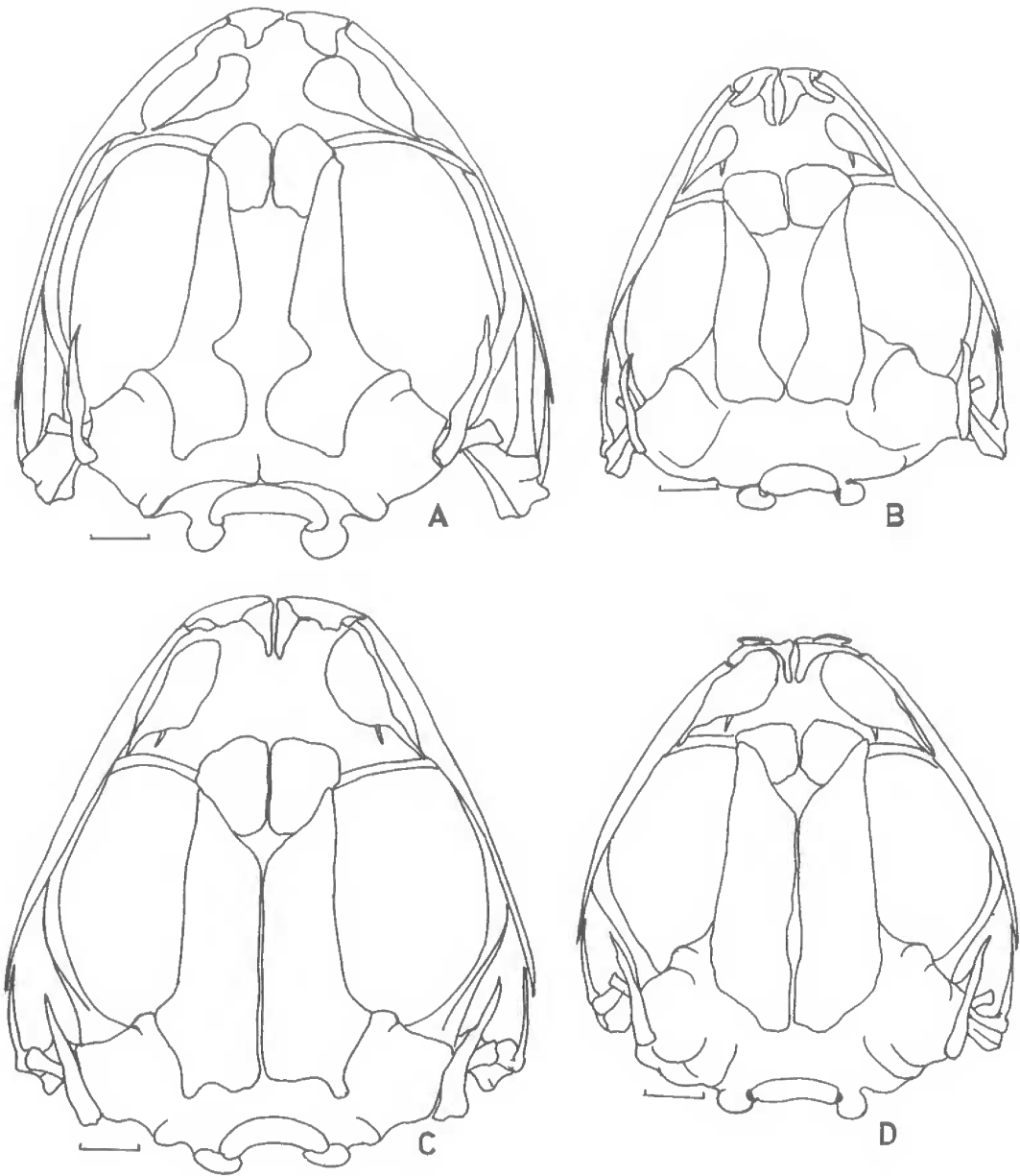


FIG. 1: A. Dorsal aspect of the skull of *Tardactylus rheophilus*.
B. Dorsal aspect of the skull of *T. acutirostris*.
C. Dorsal aspect of the skull of *T. eungellensis*.
D. Dorsal aspect of the skull of *T. diurnus*.

Toes unwebbed, but with distinct toe fringes. Subarticular and plantar tubercles of toes are always present. Only the inner metatarsal tubercle is present. Phalangeal formula of fingers 2-2-3-3 and of toes 2-2-3-4-3.

OSTEOLOGY: Only the diagnostic, and corrected characters and those which have not been mentioned previously will be presented below, for all other osteological data see Lynch (1971). Fronto-parietal fontanelle may be present or absent; nasal variable in size; sphenethmoid divided; length of zygomatic rami of squamosal variable; vomerine bone narrow on median border of choanae, vomerine teeth absent; maxilla toothed; pedicellate teeth; 8 presacral vertebrae, connected with intervertebral discs; cotyles of cervical vertebrae are widely spaced; 1st and 2nd vertebrae free; sacral vertebrae with expanded diapophyses, urostyle with two condyles; cricoid does not form a complete ring ventrally; median frenulum chordiae vocalis of larynx absent; alary process broad, wing-like (Fig. 2A); pectoral girdle arciferous; sternum cartilaginous, variable in shape; omosternum present or absent; carpals consists of a radiale, ulnare, naviculare, 1st, 2nd and 3rd carpale and a large fused bone consisting of 4th carpale and postaxial centrale; prepollex pointed; 1st, 2nd and 3rd tarsale as well as the prehallux present.

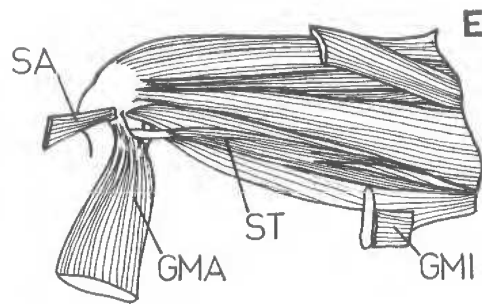
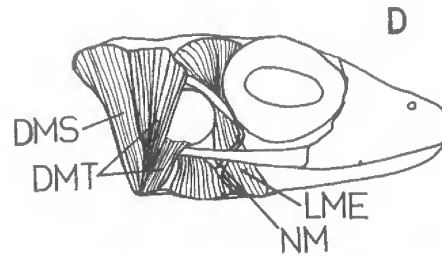
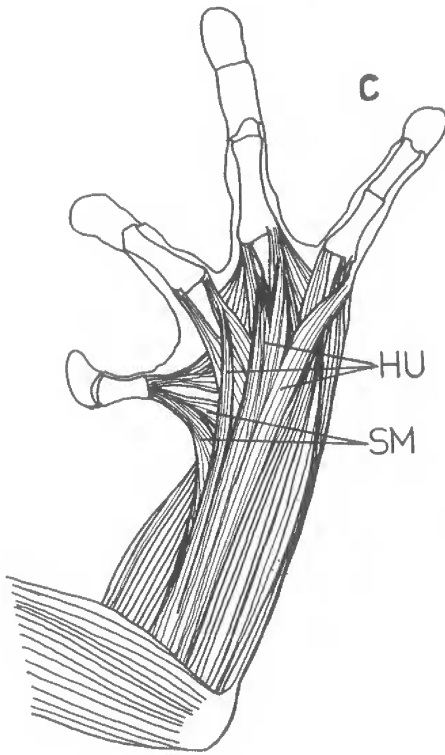
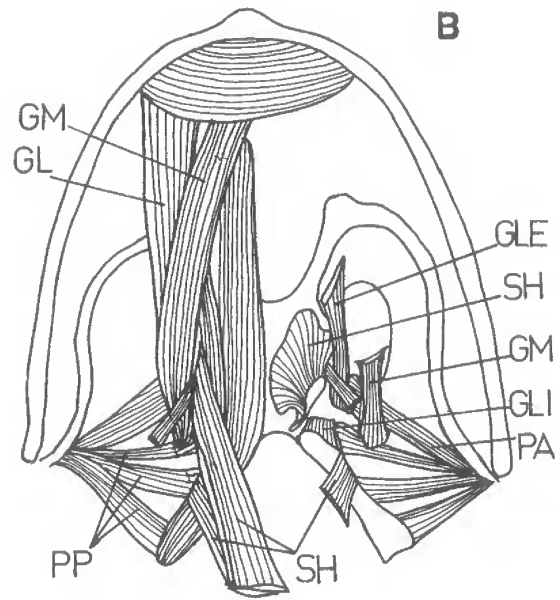
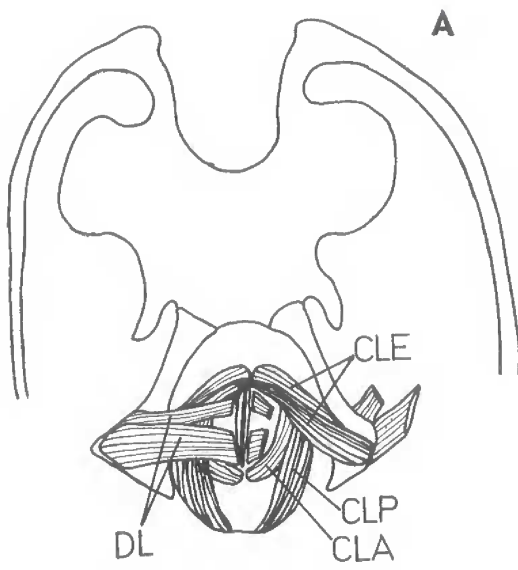
MYOLOGY: Depressor mandibulae consists of two main slips, a slender pars scapularis originating from the scapula and a strong pars tympanicus which originates from the squamosal, and posterior surface of prootic, and a short slender slip from the auditory capsule; *M. levator mandibulae subexternus* absent; *nervus mandibulae* is superficial and lies lateral to the *M. levator mandibulae externus* (Fig. 2D); *M. supracroideus profundus* and *superficialis* are not fused; *M. omohyoideus* present inserting midway between base of posterior lateral process and the manubrium of the hyoid apparatus; *M. geniohyoideus medialis* is ventral to the *geniohyoideus lateralis* and inserts on distal half of posterior lateral process of the hyoid plate; *M. geniohyoideus lateralis externus* inserts on proximal portion of posterior lateral process and the *internus* on the proximo-medial third or two-thirds of thyrohyal; *M. sterno-hyoideus dorsalis* is free from the *ventralis* and inserts on proximo-lateral third of thyrohyal; *pars medialis* and *lateralis* of *M. sterno-hyoideus lateralis* are distinct, the former inserts on the base of hyale, curves medially toward midline, and then curves laterally to end at base of posterior lateral process, whereas *pars lateralis* inserts on the hyoid plate just lateral to *medialis*, but restricted along its middle third; *M. hyoglossus* consists of one pair of muscles; *M. petrohyoideus anterior* inserts on base of alary process, lateral to insertion of *M. sterno-hyoideus ventralis*; three slips of *M. petrohyoideus posterior* all inserting on dorsal surface of thyrohyal (Fig. 2B); *M. dilatator laryngis* consists of two slips in *T. rheophilus* (Fig. 2A) and only one slip in *T. diurnus*, *T. eungellensis* and *T. acutirostris*; *M. constrictor anterior* consists of one slip; apical elements of *M. submaxilaris* absent; distally the *M. humerodorsalis* fragmented into the first, second, third, fourth phalangeal slip, and the fourth metacarpal slip in *T. diurnus*, *T. eungellensis* and *T. acutirostris*, whereas the first is absent in *T. rheophilus* (Fig. 2C); *M. externus digitorum brevis superficialis* of 2nd finger originates from the ulnare; *M. supinator manus* with two slips, one originates from dorso-lateral surface along mid one-third of radio-ulna, and another from disto-lateral surface of humerus, both join together distally to insert on dorsal surface halfway down

the first finger (Fig. 2C); *M. palmaris longus* is entire; tendo superficialis of the 2nd, 3rd and 4th fingers originate from the aponeurosis palmaris; *M. adductor longus* present; distal tendon of *M. semitendinosus* lies dorsal to (*T. acutirostris*, *T. rheophilus*, Fig. 2E) or pierces through *M. gracilis major* (*T. diurnus* and *T. eungellensis*); accessory slip of *M. semitendinosus* which joins the adductor magnus is absent; *M. extensor cruris brevis* lies medial to the *M. tibialis anticus brevis* and is as long as the entire length of the cruris; *M. tibialis anticus brevis* slender, originates on proximo-lateral fourth of cruris, and inserts on proximo-dorsal surface of tibio-fibulare fusion; *M. extensor digitorum communis longus* consists of a single slip, joins with the distal tendon of the extensor brevis superficialis of the 4th toe to insert on the disto-dorsal portion of the metatarsal of the 4th toe; a tendinous tissue which originates from the aponeurosis plantaris joins the formation of the tendo superficialis of the third toe; accessorius slip of the *M. abductor brevis plantaris hallucis* absent; *M. abductor prae hallucis dorsalis* is short, inserting on postero-dorsal surface of the prehallux; the ventralis inserts on the posterior surface of the basal segment of the prehallux; the *M. lumbricalis longus digiti* of the 2nd toe absent; *M. extensor brevis superficialis* of 5th toe absent; all three slips of *M. extensor brevis medii* supplying the 1st, 2nd and 3rd toes are present.

EGGS AND TADPOLES: Eggs are relatively large, 2.2–2.6 mm in diameter, encapsulated individually with a clear gelatinous capsule up to 4.6 mm in diameter. In *T. diurnus*, *T. eungellensis* and *T. acutirostris*, egg masses consist of 2–3 dozen eggs deposited under rocks in creeks. Tadpoles have a dextral anal opening, sinistral spiracle, and are characterized by the umbrella-shaped labium forming a sucker mouth, distinct lateral line organs on head and body, weak jaws; labial tooth rows are absent in *T. diurnus* and *T. eungellensis*, but present in *T. acutirostris*.

REMARKS: All members of the genus have distinct lateral fringes, as do *Crinia haswelli*, *C. sloanei* and *C. riparia*; lack of the outer metatarsal tubercles is shared with *Crinia darlingtoni*, *C. haswelli*, *C. laevis*, *C. leai*, *C. rosea*, and *C. victoriana*. All members have maxillary teeth as in *Crinia*; absence of vomerine teeth is shared with the majority of myobatrachines. Mature males of *Taudactylus* have dark brown to black testes and this is shared with *Kyarranus* and *Crinia* amongst the Australo-papuan leptodactylids. All members of this genus are primarily diurnal and restricted along mountain rainforest creeks.

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- FIG. 2: A. Ventral aspect of the hyoid apparatus (note the expanded alary process), and ventral laryngeal muscles of *Taudactylus rheophilus*. CLA, constrictor laryngis anterior; CLE, constrictor laryngis externus; CLP, constrictor laryngis posterior; DL, dilatator laryngis.
- B. Ventral aspect of hyoid muscles of *Taudactylus diurnus*. GL, geniohyoideus lateralis; GLE, geniohyoideus lateralis pars externus; GLI, geniohyoideus lateralis pars internus; GM, geniohyoideus medialis; PA, petrohyoideus anterior; PP, petrohyoideus posterior; SH, sternohyoideus.
- C. Dorsal aspect of forearm muscles of *Taudactylus rheophilus*. HU, humerodorsalis; SM, supinator manus.
- D. Head muscles of *Taudactylus eugellensis*. DMS, depressor mandibulae pars scapularis; DMT, depressor mandibulae pars tympanicus; LME, levator mandibulae externus; NM, nervus mandibulae.
- E. Ventral muscles of the thigh of *Taudactylus rheophilus*. GMA, gracilis major; GMI, gracilis minor; SA, sartorius; ST, semi-tendinosus.



KEY TO SPECIES OF THE GENUS TAUDACTYLUS

1. Dorso-lateral skinfold present; three tubercles, each marked by a black blotch arranged in a triangle are present on the coccygeal area
 *Taudactylus acutirostris*
 Not as above 2
- 2(1). Head broad, HW/SV ratio more than 0.380; subarticular tubercles present on all fingers; snout vertical in profile (Fig. 4c) digital disc narrow, 1.25 times width of digits; male with a vocal sac, a pair of slit openings and subcutaneous nuptial glands on 1st and 2nd fingers; a distinct black and light irregular marking on the flank between base of forearm and groin
 *Taudactylus rheophilus*
 Not as above 3
- 3(2). Dorsum light background with distinct irregular dark markings; ventral surfaces of thighs immaculate cream or yellow, or only the antero and postero-distal portion of the thighs are dark spotted. Females reach up to 35.0 mm, males averaging 26.0 mm *Taudactylus eungellensis*
 Dorsum dark olive background, irregular dark marking hardly distinguishable; ventral surfaces of thighs greyish cream and heavily spotted; abdomen and throat generally with dark brown spots. Females reaching up to 30.0 mm, and males averaging 25.0 mm *Taudactylus diurnus*

Taudactylus diurnus Straughan and Lee

(Figs. 1D, 2B, 3B,F, 4B, 5, 6)

Taudactylus diurnus Straughan and Lee, 1966, p. 63.

MATERIAL EXAMINED

HOLOTYPE: Adult male, QM J13398, from Green's Fall, Maijala National Park, Mt Glorious, Queensland, collected by I. R. Straughan, 12.v.1965.

PARATYPES: (28) 3 ♂, 4 ♀, 6 unsexed (3 juv) (QM J13399-411); 2 ♂, 4 ♀, (AM R24656-61); 3 ♂, 3 ♀, (WAM R26337-42).

OTHER MATERIAL.—(70) Mt Glorious, SE Queensland, 18 ♂ (DSL 1083-4, 5128, 5130, 5134-5; 5264, 5266-7, 5395, 5399, 5400-1, 5404-7, 5409), 21 ♀ (DSL 3084-5, 5121-7, 5131-3, 5136-7, 5140, 5271, 5396, 5402-3, 5411); Kondallilla, SE Queensland, 13 ♂ (DSL 5944-5, 5949-50, 5955-8, 5961; 6240-3), 8 ♀ (DSL 5946-7, 5953, 5959-60, 5962), 9 juveniles (DSL 5943, 5948, 5951-2, 5954, 6239, 6244, 6247-8). Skeleton (DSL 1086) and cleared specimen (DSL 1085) are from Mt Glorious, SE Queensland.

DIAGNOSIS: This species is characterized by the following combination of characters: absence of dorso-lateral skinfold; head narrow, HW/SV ratio 0.288-0.333; snout slightly protruding and sloping inward in profile; dorsal aspect of snout blunt; subarticular tubercle between phalanges of fingers absent; skin granular; vocal sac absent in males; one rounded dark grey nuptial gland present on medio-dorsal part of hand of breeding males; a short black stripe from behind eye to base of forearm, sometimes accompanied by another lighter band ventral to the first; width of toe fringes about 2/5 width of toe;

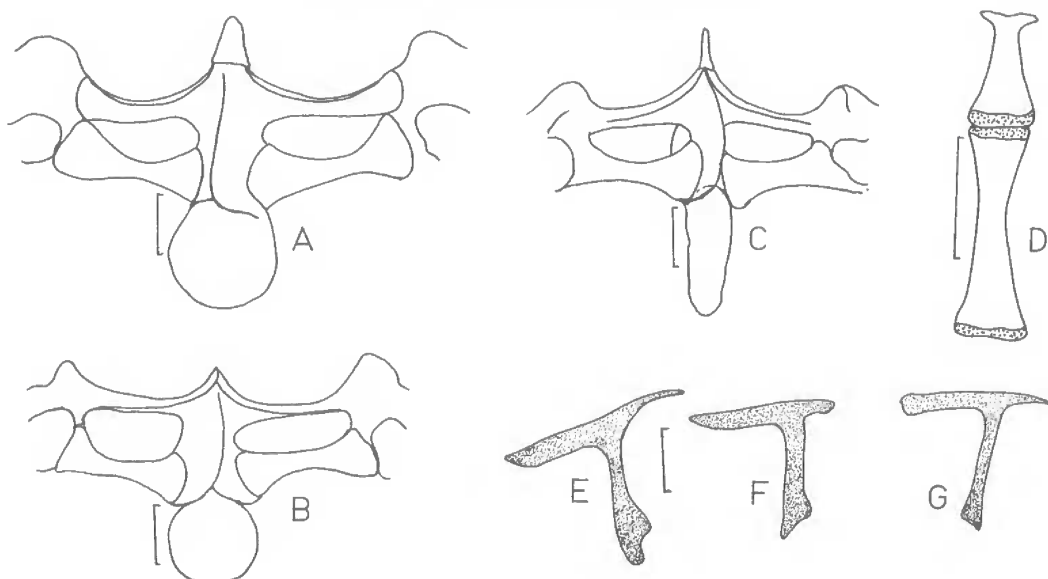


FIG. 3: A. Ventral aspect of the pectoral girdle of *Taudactylus rheophilus*.
 B. Ventral aspect of the pectoral girdle of *T. diurnus*.
 C. Ventral aspect of the pectoral girdle of *T. acutirostris*.
 D. Penultimate and terminal phalanges of the 4th toe of *T. eungellensis*.
 E. Lateral aspect of the squamosal of *T. rheophilus*.
 F. Lateral aspect of the squamosal of *T. diurnus*.
 G. Lateral aspect of the squamosal of *T. acutirostris*; right arm is the otic ramus.

disc of digits large, about 1.5 times width of neck of disc. It only differs from *eungellensis* by its smaller size, darker dorsal background colour and the heavily spotted ventral surfaces of the thighs.

DESCRIPTION AND VARIATION: The description of Straughan and Lee (1966) is sufficient, however it is noteworthy to add the following: This species is a moderate to large sized *Taudactylus* frog, males are 22.0–27.2 mm (mean 24.6 mm, N = 31), and females are 23.3–30.6 mm (mean 28.8 mm, N = 29) in SV-length; head narrow, HW/SV ratio 0.288–0.353; dorso-lateral skinfold absent; skin granular, subarticular tubercles of fingers absent; toe fringes broad, half the width of the toe; male with rounded dark grey nuptial pad on dorso-medial portion of hand; cross-bands on fore and hind limbs oriented at right angles to the longitudinal axis of the limbs; ventral surface of males white or grey with greyish brown spots on throat and pectoral region, ventral surface of females cream or yellowish and sparsely spotted with grey on throat and pectoral region. Nasal bones moderately large; vomerine bone very small; fronto-parietal fontanelle absent or just a narrow suture (Fig. 1D); zygomatic rami of squamosal one third length of otic rami (Fig. 3F); omosternum absent; sternum rounded (Fig. 3B).

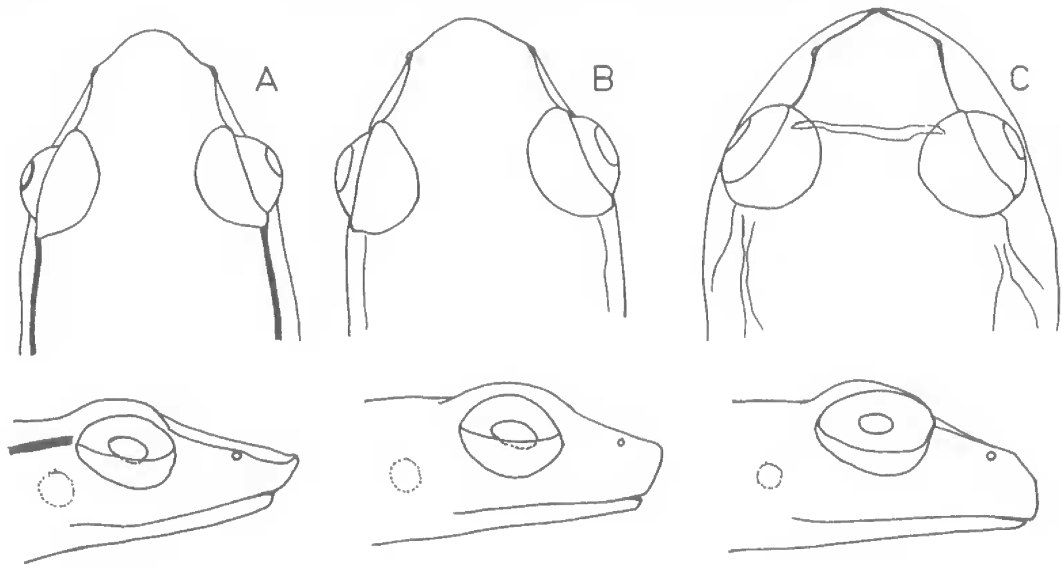


FIG. 4: A. Dorsal and lateral aspect of head of *Taudactylus acutirostris*.
 B. Dorsal and lateral aspect of head of *T. diurnus*.
 C. Dorsal and lateral aspect of head of *T. rheophilus*.

TADPOLES: Moderate sized tadpoles with rounded snout, rounded tail tip, dextral anus, sinistral spiracle, characterized by the absence of labial teeth and the umbrella-shaped lip, and with the labial papillae completely surrounding the labium (Fig. 6). Details of tadpoles are presented elsewhere (Liem, MS1).

BIOLOGY: Large eggs are deposited in gelatinous clumps under rocks in water in mountain creeks; tadpoles are bottom dwellers and scrape food from the substrate with their umbrella-shaped lip. Tadpoles and adults are sympatric and synchronopatric with *Adelotus brevis*, *Myxophyes fasciolatus*, *Hyla pearsoniana* and *H. lesueuri* on Mt Glorious, and with *Hyla lesueuri*, *H. chloris*, *H. pearsoniana*, *Mixophyes fasciolatus*, *Adelotus brevis* and another unnamed genus in Kondallilla, SE. Queensland. Breeding peak occurs between late November and late April, whereas tadpoles are found throughout the year. Amplexus is inguinal.

CALL: Contrary to Straughan and Lee (1966), it was found that the males of this species do call. Their call is a very soft chuckling sound repeated 1–2 or 4–5 times in quick succession. It is hardly audible in the field, probably because of its infrequent call and the loud background noises of rushing water current. The call could clearly be heard when males are placed in an aquarium in a quiet room. It takes about 4–5 minutes from one to the next call of one individual. Lack of a vocal sac may be the main cause of the softness of the call.

HABITAT: *Taudactylus diurnus* is restricted along the rocky mountain creeks in rain forest between 500–600 m above sea level on Mt Glorious, in wet sclerophyll forest between 400–500 m above sea level in Kondallilla, 100 km N. of Brisbane, SE. Queensland. This species prefers shady and permanent flowing mountain creeks. They were collected on rocks near water, on creek banks, as well as on rock ledges with seepage water. It clings with its toe discs on rock walls or on rocks in the creeks, and when disturbed it jumps into the water and stays on the bottom for up to 15 minutes.

In both localities this species is active only during the day time.

DISTRIBUTION: At present it is known from only 2 localities; i.e. Mt Glorious, and Kondallilla, 3 km SW. Montville, SE. Queensland.

REMARKS: Mt Glorious and Kondallilla populations are identical in all measurements and colouration. However SV length in both populations of *T. diurnus* is significantly smaller than in its closely related species *T. eungellensis* from Eungella-Finch Hatton area, central eastern Queensland.

***Taudactylus eungellensis* sp. nov.**

(Figs. 1C, 2D, 3D, 8)

MATERIAL EXAMINED

HOLOTYPE: Adult male, QM J22433, Eungella, 75km W. of Mackay, central eastern Queensland, 900m above sea level, collected by David S. Liem, 24.xi.1971.

PARATYPES: 5 ♂ (QM J22434–7, DSL 6053), 13 ♀ (QM J22442–9, DSL 60650, 6056, 6061, 6065, 6069), Finch Hatton Gorge, 60km W. of Mackay, central eastern Queensland, 19.v.1972; 2 ♂ (QM J22438–9), same locality, 24.xi.1971; 3 ♂ (QM J22440–1, DSL 4823), type locality, 19.xii.1971; 2 ♂ (DSL 5441, 6062), 5 ♀ (DSL 6049, 6055, 6058, 6073, 6076), 8 juveniles (DSL 6044–5, 6047–8, 6067, 6071, 6074–5), 3 skeletons (DSL 5940–1), type locality; 1 (DSL 4822), Finch Hatton Gorge, 60km W. of Mackay, central eastern Queensland. A total of 35 tadpoles of stages 25, 26, 27, 28, 30, 34, 38, 39, 40, and 42 from Eungella and Finch Hatton Gorge were examined. All paratypes were collected by David S. Liem.

DIAGNOSIS: *T. eungellensis* closely resembles *T. diurnus* and could be characterised as follows: dorso-lateral skinfold absent; head narrow, HW/SV ratio 0.285–0.341; snout protruding and sloping inward when viewed in profile; as in *T. diurnus* dorsal aspect of snout blunt or slightly rounded; subarticular tubercles of fingers absent; mature males with rounded nuptial pad on back of the hand; vocal sac absent in males; background colour of dorsum yellowish green, with distinct black colour markings; irregular X-shape marking on the back behind the head is characteristic to this species. This species could be distinguished from its closely related species, *T. diurnus*, by its larger SV length and the immaculate yellow ventral surfaces of abdomen and thighs. Generally the anal tubercles which are present on each side of the anal opening are more pronounced in *T. eungellensis*.

DESCRIPTION OF HOLOTYPE: SV length 26.0 mm; tibia length 14.5 mm, 0.558 of SV length; head width 8.6 mm, 0.331 of SV length; dorsal aspect of snout bluntly acuminate, slightly protruding and in profile sloping inward; EN length 2.4 mm; IN length 3.2 mm; loreal region slightly concave; canthus rostralis angular in section, forming a distinct angle at level of nostrils to converge anteriorly at tip of snout; pupil horizontally oval; tympanum hidden; tongue 1.25 as long as wide, widest half way down its length, posterior two-thirds of tongue free; choanae moderately large, round; vomerine teeth absent; vocal sac absent; fingers unwebbed, distally expanded into discs; longitudinal groove on disto-dorsal portion of disc present. Length of fingers from shortest to longest 1-2-4-3; phalangeal formula of hand 2-2-3-3; terminal phalanges of fingers and toes T-shaped; metacarpal tubercles present on all metacarpo-phalangeal joints; subarticular tubercles absent; lateral palmar tubercle rounded and twice that of the oval inner one; mature males with greyish finely spinulated rounded nuptial pad on back of hand at base of 2nd and 3rd finger; toes not webbed, but broadly fringed; fringe width up to half width of toe; distally the toes are expanded into discs with longitudinal groove; length of toe from shortest to longest 1-2-3-5-4, and phalangeal formula from 1st to 5th toe, 2-2-3-4-3; metatarsophalangeal tubercles on base of toes ovoid; inner metatarsal tubercle ovoid; outer one absent.

Skin of dorsum chagreen with tubercles; a distinct conical tubercle present on postero-dorsal portion of thigh on each side of cloaca; postero-medial portion of thighs heavily granular; throat, abdomen, and ventral surfaces of thighs and tibia smooth; cloacal opening ends along a tube directed downward at mid level of thighs. Dorsal ground colour yellowish tan with rich irregular dark brown or black markings; broad interorbital transverse band crosses head, with two others anterior to this; the back is marked with an irregular X-shaped marking; coccygeal region with irregular dark markings; black band runs from behind the eye to the base of the forearm; flank with irregular dark markings; forelimbs with 3 dark crossbands; fingers crossbanded, 3 dark cross bands on the 3rd finger; 3 dark cross bands on dorsal surfaces of thighs, 2 broad and 2 narrow cross bands on tibia, 2 cross bands on the heel; 3rd and 5th toes crossbanded, whereas the 3 inner toes are immaculate yellowish. Throat and abdomen immaculate cream coloured; ventral surfaces of fore-limbs, thighs, tibia and tarsus bright yellow.

DESCRIPTION AND VARIATION: Seven males, 25.0–28.0 mm (mean 25.9 mm) and 24 females, 27.6–35.9 mm (mean 31.2 mm) in SV length; TL/SV ratio 0.465–0.541 in males, 0.435–0.558 in females, 0.488–0.593 in juveniles. HW/SV ratio 0.285–0.341 in males, 0.290–0.331 in females, 0.316–0.346 in juveniles; EN/IN ratio 0.641–0.839 in males, 0.525–0.788 in females, 0.580–0.833 in juveniles. Females are significantly larger than males, and mature males can easily be distinguished from the females by the presence of a dark rounded nuptial pad on the back of the hand. Some individuals collected from Eungella are dark and the dorsal dark colouration is vaguely distinguishable; ventral surfaces of body and limbs of these dark individuals are bright yellow, spotted with dark brown spots on the throat and disto-ventral surfaces of the thighs. Colour markings are more pronounced in juveniles and in some individuals ventral dark blotches extend from the throat to half way down the abdomen. Males without vocal sac; mature males easily

distinguished by the dark roundish nuptial pad on dorsal surface of hand. Nasal bones moderately broad, widely separated from each other and not touching the sphenethmoid; fronto-parietal fontanelle absent (Fig. 1C); zygomatic rami of squamosal about $\frac{1}{3}$ – $\frac{1}{2}$ as long as that of the otic rami; omosternum absent; sternum rounded.

CALL: High pitched metallic tinkering noise, which sounds like a little hammer tapping a metal plate repeated 4–5 times in quick succession. The high pitched metallic sound of *T. eungellensis* could easily be distinguished by ear from the hardly audible *T. diurnus* call, and from the moderate tapping sound of *T. acutirostris*.

BIOLOGY: *T. eungellensis* differs from *T. diurnus* in that the former is active during the day as well as at night. Males were heard calling during the day as well as at night, some females were collected while foraging at night. They are found along small rainforest mountain creeks (Eungella) as well as in boulder strewn streams at Finch Hatton. Males call from under rocks and crevices in shady places along the creeks, whereas the females are found almost everywhere hopping on rocks and boulders along the creeks and streams. As in other *Taudactylus* species, when disturbed they escape into the water and remain submerged on the bottom for a considerable length of time. Large eggs measuring 2.2–2.6 mm in diameter, numbering 30–50 in an egg mass, are deposited under rocks in the water. Several egg masses were found in December. Males were heard calling in November and December as well as in May. Tadpoles are found in November, December and May. Numerous juveniles were observed and collected in May. From this evidence the breeding peak of this species is probably in summer. Amplexus is inguinal.

TADPOLES: As in *T. diurnus*, tadpoles of *T. eungellensis* are characterized by the umbrella-shaped lips, weak narrow keratinized jaws, absence of labial teeth, dextral anal opening, and left spiracle. Lateral line organs appearing as dots are present surrounding the eye, extending posteriorly behind the eye and forked into two branches, one leading toward the anal region and another extending along the muscular tail. Tail tip is rounded. There are no differences in measurements and ratio between *T. eungellensis* and *T. diurnus* tadpoles. Tadpoles of *T. eungellensis* differ from *T. diurnus* in the prominent X-shaped marking on the dorsal side of the body and the distinct papillar ridges on the lower labium (Fig. 8), comprising an inverted V-shaped outer ridge, and a pair of ridges at each side of the former which orient toward the mouth opening when at rest and lie parallel to the jaws when the mouth is forced open. Apparently these ridges are the degenerated labial tooth rows of the ancestral forms. Tadpoles of *T. eungellensis* and *T. diurnus* differ from *T. acutirostris* by the narrower body, absence of labial tooth rows, and the continuous row of labial papillae forming a complete umbrella-shaped lip. As in tadpoles of the other known species, they are bottom dwellers in fast running water as well as in rock pools. *T. eungellensis* is synchronopatric with *Hyla lesueuri* and *H. chloris*.

HABITAT: This species is found along small creeks in the rain forest (Eungella, Finch Hatton Gorge), as well as in wet sclerophyll forest (Finch Hatton Gorge, central Queensland). The vertical distribution ranges from 500–900 m above sea level.

DISTRIBUTION: At present it is only known from Eungella, 75 km W. of Mackay, and Finch Hatton Gorge, 60 km W. of Mackay, central eastern Queensland.

ETYMOLOGY: The specific name refers to the locality, Eungella, where the holotype was collected. The name Eungella is of aboriginal origin meaning 'Land of the cloud'.

***Taudactylus acutirostris* (Anderson)**

(Figs. 1B, 3C,G, 4A, 5, 7)

Crinia acutirostris Anderson, 1916, pp. 1–20, 1 pl.; Parker, 1940, p. 83.

Taudactylus acutirostris: Straughan and Main, 1966, p. 11.

HOLOTYPE: 1 ♂, 1 ♀, Malanda, North Queensland, collected by Dr E. Mjoberg, 1910–1913.

MATERIAL EXAMINED: (57) North Queensland: 24 ♂ (DSL 5983, 5985, 5997, 5999, 6000, 6002, 6004–11, 6028, 6020–2, 6031, 6034–5, 6037, 6039 and 6041), 5 ♀ (DSL 5984, 6013–4, 6016, 6032), Mt Lewis; 7 ♂ (DSL 4801–7), 2 ♀ (DSL 4809–10), Speerwah; 2 ♂ (DSL 4812, 4815), 4 ♀ (DSL 4813–4, 4817–8), 1 juvenile (DSL 4816), 15 km S. of Mareeba; 1 ♂ (DSL 5987), 1 ♀ (DSL 5988), Tully's Falls; 4 ♂ (DSL 5989–92), Charmillan Creek, 10km N. Tully's Falls; 3 ♂ (DSL 5993–5), Tschooratypa Creek, Palmerston N. P.; 1 ♀ (DSL 6192), Kuranda; 1 ♀ (DSL 5986), Jullaten, Mt Molloy; 1 ♀ (DSL 3080), Malanda; 31 tadpoles, Mt Lewis and Tully's Falls, of stages 25–27; skeleton (DSL 4807), Speerwah; cleared specimen (DSL 4218), Kuranda.

DIAGNOSIS: Distinct light dorso-lateral skinfold; three tubercles arranged in a triangle on the posterior part of the back; wedge shape snout curved upward in profile. Dorsum immaculate brown meeting along a sharp line the black lateral colour which extends from behind the eye to the groin; ventral surfaces of body brownish cream to reddish (cream white in preservative) with extensive irregular dark blotches and markings; a relative broad cream marking runs along the margins of the throat. Head narrow, HW/SV ratio 0.301–0.351; fringes of toes narrow, $\frac{1}{4}$ – $\frac{1}{3}$ width of toe.

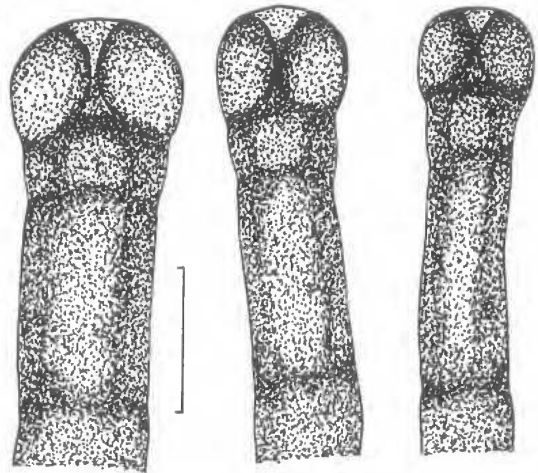


FIG. 5: Dorsal aspect of the distal part of the 4th toe of *Taudactylus diurnus* (left), *T. acutirostris* (middle) and *T. rheophilus* (right).

DESCRIPTION AND VARIATION: Anderson's (1916) and Parker's (1940) definitions are quite sufficient, however the following characters are worth mentioning. This species is a moderate sized taudactylid (males 21.0–26.3 mm (mean 23.66 mm, N = 39), females 21.0–27.7 mm (mean 27.19 mm, N = 17), in SV length); head narrow, HW/SV ratio 0.301–0.351 and equal in both sexes; disc of digits relatively small, 1.25 width of base of discs. Dorsal skin of body smooth or chagreen and some individuals with distinct short skinfolds on the body, dorsal surfaces of the tibia and posterior surface of the thigh near the cloacal opening. In some individuals the back is marked with inverted V-shaped dark markings, and usually the tubercles which are arranged in a triangle on the lower back are each marked by a black spot. In some individuals the groin is reddish, orange or yellow and in those individuals the proximal surfaces of thigh and ventral surfaces of tibia are also brightly coloured. Generally the throat and anterior portion of the abdomen are cream with dark brown blotches; a round cream spot is present near the base of each forearm, it is very clear when the ventral surfaces of the body are heavily pigmented. Dorsal surfaces of the fore and hind limbs are crossbanded. Mature males with a vocal sac which opens by a slit on each side of the tongue; nuptial pad present, a swollen spinulated pad on the base of the 1st, 2nd and sometimes the 3rd finger; nasals narrow club-shaped bones which are widely separated from each other and not touching the sphenethmoids; fronto-parietal fontanelle narrow, about as wide as the fronto-parietal width at its narrowest portion (Fig. 1B); zygomatic rami of squamosal is 0.3 to 0.5 the length of the otic rami (Fig. 3G); omosternum present; sternum cartilaginous and elongated (Fig. 3C).

TADPOLES: As in *T. diurnus* and *T. eungellensis*, tadpoles have rounded snout in profile and rounded tail tip, spiracle lateral left, and dextral anal opening. Unlike the two species mentioned above, *T. acutirostris* tadpoles are toothed (tooth row formula I, 1/1, I, I($\frac{1}{4}$)), and labial papillae are deeply indented posteriorly and to lesser extent laterally (Fig. 7); the body is broad, BW/BL ratio more than 0.679; the body wall of the posterior portion of the body is transparent and pigmentless, hence the gut is visible from the dorsal, lateral and ventral view. Only the lateral and dorsal side of the head region, the base of the muscular tail, and to a certain extent the tail fins are pigmented. ST length of stages 25–26 are considerably larger in *T. acutirostris* than in *T. diurnus* or *T. eungellensis*, 16.0–36.1 mm for the former against 17.0–30.0 mm for the others; TL/ST and TH/TL ratios are similar for the three species. Unlike any other known Australo-papuan tadpoles, the outer upper labial tooth row lies in alignment with the labial papillae (Fig. 7).

BIOLOGY: Breeding males call during the day as well as during the night from rocks or under roots of shrubs along shady creeks usually with swift running water. Amplexus is inguinal. Breeding was observed in late November through January. Eggs are large 2.2–2.7 mm in diameter and laid as a gelatinous clump of about 25–40 amongst rock in the water usually under heavy shaded places. Tadpoles are bottom dwellers and spend most of the time scraping on rocks or vegetation with their expanded umbrella-shaped lip; the latter also serves for clinging on the substrate. Adults and tadpoles are sympatric and

synchronopatric with *Hyla dayi*, *Hyla spp.*, *Sphenophryne pluvialis*, *Cophixalus ornatus*, *Hyla eucnemis*, *Mixophyes schevilli* in Tinaroo Creek, Kuranda; with *Taudactylus rheophilus*, *Hyla eucnemis*, *H. dayi*, *H. chloris*, and *Mixophyes schevilli* on Mt Lewis; and with *Nyctimystes hosmeri*, *Hyla lesueuri*, *H. dayi*, *H. eucnemis* at Tully's Falls, north Queensland.

CALL: Sharp pitched tapping sound repeated 3–4 times in quick succession. Its loudness is between *T. diurnus* and *T. eungellensis*.

HABITAT: This species is found along small creeks in rain forest (Tully's Falls, Tschooratypa Creek, Palmerston NP, Kuranda, Mt Lewis in N. Queensland) and in wet sclerophyll forest (Tinaroo Creek Road, Jullaten, Speerwah, N. Queensland). These frogs are active during the day, but males were also heard calling at night on Mt Lewis. The vertical distribution ranges from 600 to 1200 m above sea level.

DISTRIBUTION: Along the Great Dividing Range of Queensland. N. Queensland: Mt Lewis, Mt Spurgeon, Jullaten, Kuranda, Speerwah, Malanda, Tinaroo Creek Road, Tully's Falls, Charmillan Creek, 10 km N. Tully's Falls, Tschooratypa Creek–Palmerston NP. Mundubbera, SE. Queensland [?] (Parker, 1940).

REMARKS: Alice Grandison examined the specimen of *Crinia acutirostris* (BM 1938.7.2.I) from Mundubbera, SE. Queensland, which was reported by Parker (1940); although that specimen is in poor condition, she notes (pers comm.) that that specimen ties with *acutirostris* better than with the other three taxa recognized here. Attempts to verify the occurrence of *T. acutirostris* in the Mundubbera area, SE. Queensland, have been unsuccessful.

***Taudactylus rheophilus* sp. nov.**

(Figs. 1A, 2A,C,E, 3A,E, 4C, 5; Plate 29)

HOLOTYPE: Adult female, QM J22418, from Mt Lewis, 1200m above sea level, north Queensland, collected by William Hosmer, 26.xii.1971.

PARATYPES: 2 ♂ (QM J22419–20), 2 ♀ (QM J22426–7), and 2 juveniles (QM J22429–30), type locality, W. Hosmer, 29.iv.1972; 8 ♂ (QM J22421–5, DSL 5964, 5966, 5968); 3 ♀ (QM J22428, DSL 5963, 6324), 2 juveniles (QM J22431–2), type locality, D. S. Liem and W. Hosmer, 27 May 1972; 2 ♀ (DSL 4880, 5975), 12 juveniles (DSL 5482–3, 5933, 5937, 5967, 5972–4, 5976–9), skeleton (DSL 5480), cleared specimen (DSL 5936), type locality.

DIAGNOSIS: This species is distinguishable from the other three species by the following combinations of characters: snout not shovel shaped, dorsal aspect of snout acuminate, vertical in profile and not protruding; head broad, HW/SV ratio 0.365–0.422; ventral surface of body greyish brown with large roundish cream blotches on pectoral region, anterior abdomen, and on flank between base of forearm and groin; mature males with subcutaneous nuptial glands (not spinulated pad) on the base of 1st and 2nd fingers; a narrow greyish inter-orbital streak across the anterior portion of the upper eyelid present; a dorso-lateral irregular light marking runs from behind the eye to the groin; discs of digits small, 1.25 the width of the neck of the disc.

DESCRIPTION OF HOLOTYPE: SV-length 28.5 mm; tibia length 13.5 mm, 0.475 of SV-length; head width 11.5 mm, 0.403 of SV-length; dorsal aspect of snout blunt, acuminate, and vertical in profile (Fig. 4C); EN 1.8 mm; IN 3.4 mm; loreal region sloping; canthus rostralis angular in section, and forming a distinct angle at level of nostrils to converge anteriorly to form an acuminate snout; pupil horizontally oval; tympanum hidden; tongue $1\frac{1}{4}$ as long as wide, widest at $\frac{2}{3}$ its length, straight anteriorly and rounded posteriorly; a distinct pit is present two-thirds down the length of the tongue; posterior two-thirds of tongue free; choanae large and round; vomerine teeth absent; fingers unwebbed, distally expanded into discs; longitudinal groove present on disto-dorsal portion of disc (Fig. 5). Length of fingers from shortest to longest 1-2-4-3; phalangeal formula of hand 2-2-3-3; terminal phalanges of fingers T-shaped; metacarpal tubercle present on all metacarpo-phalangeal joints; subarticular tubercle depressed, that of the 3rd finger usually distinct; lateral palmar tubercle rounded and twice that of oval inner palmar tubercle; toes not webbed, but with distinct toe fringes, width $\frac{1}{3}$ width of toe; distally toes expanded into discs, with longitudinal groove disto-dorsally; length of toes from shortest to longest 1-2-3-5-4; phalangeal formula of foot 2-2-3-4-3; subarticular tubercles ovoid, depressed, formula from 1st to 5th toe 1-2-2-3-2; metatarso-phalangeal tubercle on base of toes ovoid; inner metatarsal tubercle ovoid, outer one absent.

Skin of dorsum smooth, with some small tubercles; skin of throat, chest, abdomen and posterior surfaces of thighs smooth; cloacal opening directed posteriorly at mid-level of thighs.

Dorsal ground colour dark brown with black markings; an irregular greyish streak runs from behind eye to groin and a transverse streak between anterior portion of eyes; loreal region black with some irregular grey markings; lateral surface from behind eyes to half-way to groin jet black; groin region brownish; dorsal surfaces of forelimbs and fingers with dark brown crossbands on light brownish background; medial portion of back of hand immaculate cream; two distinct and one faint cross band on forearm; dark brown cross bands on dorsal surfaces of hind limbs orient obliquely on light brown background; three dark cross bands on femur; two distinct dark brown cross bands on tibia; two vague bands on metatarsal region; toes creamish grey with irregular brown bands; ventral surface of body brownish with bold irregular whitish cream markings; extensive markings extend from between the base of the forearms to halfway down the abdomen, throat with rounded spots on tan background; ventral inner surfaces of humerus and forearms immaculate cream while that of hands and fingers brown; ventral surfaces of the thighs and hind limbs with brownish background with some cream markings on the antero-ventral portion of the thighs and ventral surfaces of the tibia.

DESCRIPTION AND VARIATION: Twelve males 24.3–27.4 mm (mean 26.1 mm) and 9 females 24.1–30.5 mm (mean 28.5 mm) in SV length; HL/SV ratio 0.365–0.421 in males, 0.375–0.412 in females, 0.376–0.422 mm in juveniles ($N = 12$); TL/SV ratio 0.453–0.514 in males, 0.452–0.517 in females, 0.476–0.520 in juveniles; EN/IN ratio 0.563–0.781 in males, 0.579–0.703 in females, 0.522–0.700 in juveniles. Except for the slightly longer SV length in females there is no intersexual variation in the measurements.

Dorsal background colour dark brown to reddish brown, or greyish brown. Dorsal markings vary between individuals in regard to the distinctiveness of the dorso-lateral

irregular marking behind the eyes as well as the interorbital transverse band; some individuals have a marked black irregular hourglass pattern on the back; dorso-lateral light marking sharply meets the dark brown marking on the lateral side of the body, this dark band extends from behind the eyes to the groin; unlike that of the holotype, there is a distinct dark brown streak from below eye to upper jaw, and light cream streaks line both sides; ventral colouration brownish with extensive cream blotches; in some individuals the abdomen appears to be almost completely cream (as in 5939); inner ventral surfaces of humerus and forearm are cream in most specimens examined or yellowish green; ventral surface of fingers with distinct crossbands in some individuals; forearm creamish tan with 2–3 dark crossbands; in some specimens (QM J 22429, J 22420) the dorsal surface of the humerus is almost immaculate cream; dark cross bands on thighs vary from 4 to 6 bands, and are narrower in those with greater numbers; bands on tibia vary from 2 to 3, in some individuals these crossbands are indistinct; 2 crossbands on dorsal surface of foot; dorsal surfaces of fingers and toes are light and dark banded; males without spinulated nuptial pad, but subcutaneous nuptial glands are present on base of 1st and 2nd fingers; males with a vocal sac, and a pair of slit openings on each side of tongue. Colour markings are more pronounced in juveniles. Nasal bones narrow and widely separated from each other and not touching the sphenethmoid; frontoparietal frontanelle moderately large; zygomatic rami of squamosal as long as that of the otic rami (Fig. 3E), which distinguishes it from the three other species; omosternum present; sternum rounded (Fig. 3A).

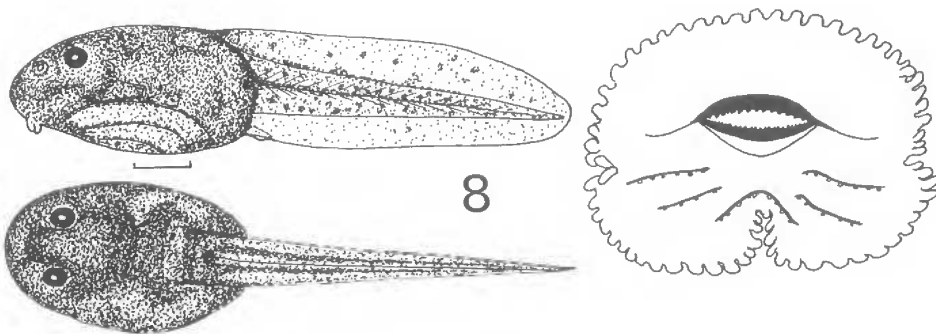
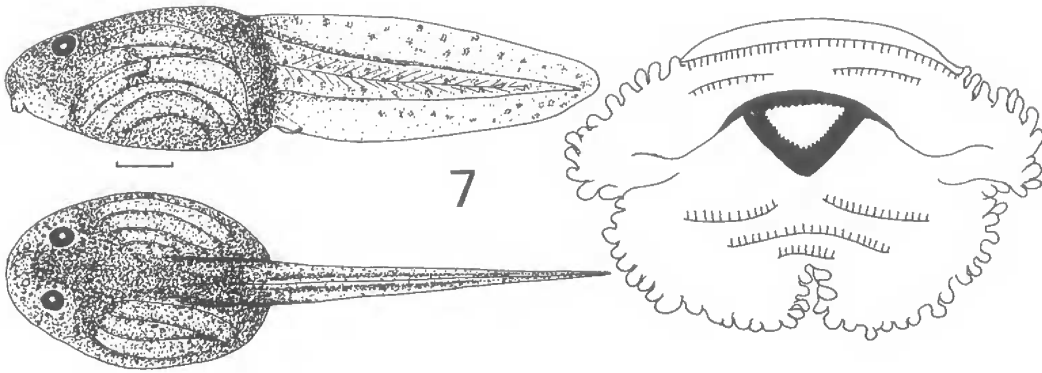
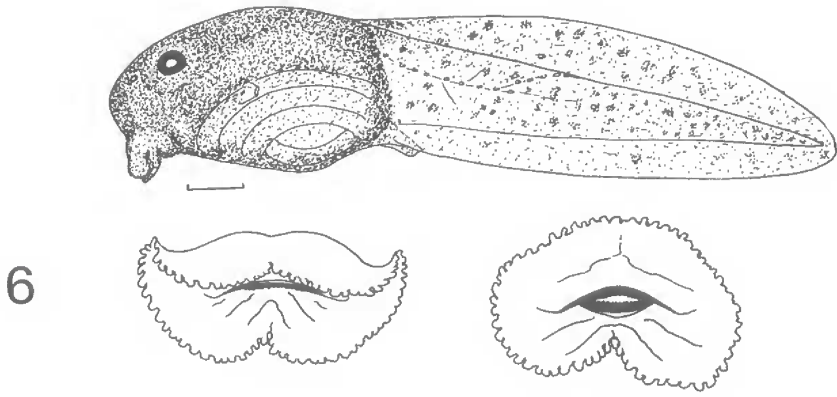
TADPOLES: Egg masses and tadpoles of *Rheophilus* have not been identified. Tadpoles of *Taudactylus acutirostris*, *Hyla eucnemis* and *Mixophyes schevili* were collected in May at the type locality of *Taudactylus rheophilus* on Mt Lewis, N. Queensland, but none could be associated with the new species.

BIOLOGY: Little is known of the life history of this species. This species is very secretive, and was found under rocks and stones under water along swift moving mountain streams, as well as under roots of shrubs. No individuals have been observed sitting on an exposed position as in the three other species. Usually only the eyes and nose stick out of the water amongst rocks. They are active during the day as well as at night. Egg masses and tadpoles of this species have not been identified. Large eggs 1.8–2.4 mm in diameter, numbering 35–50 are found in gravid females. Apparently *T. rheophilus* lays its eggs under rocks in water and the tadpoles probably resemble *T. acutirostris* in having labial teeth and interrupted labial papillae row. Juveniles were collected in December 1971 as well as in May 1972. *T. rheophilus* is synchronopatric with *Myxophyes schevilli*, *Taudactylus acutirostris*, *Hyla eucnemis*, *H. dayi*, *H. chloris*, *Cophixalus fryi*, *C. ornatus*, *Sphenophryne spp.*

FIG. 6: Lateral view of tadpole of *Taudactylus diurnus* at stage 25. Mouth of *T. diurnus* tadpole at rest (left) and open (right).

FIG. 7: Lateral and dorsal aspect of *Taudactylus acutirostris* tadpole; note the extent of transparent body wall. At right, mouth part of *T. acutirostris*; note that the outer labial tooth row lies in alignment with the labial papillae.

FIG. 8: Lateral and dorsal aspect of tadpole of *Taudactylus eungellensis*. At right, mouth part of *T. eungellensis* tadpole; note the ridges and papillae on the lower labium.



CALL: Only one male was heard calling during the day (10.00 a.m.) and this was not recorded. The call is a soft metallic tapping sound repeated 4–5 times in quick succession, the same general pattern as the other three species. The individual was calling between two rocks submerged in water and with only the head above the surface of the water. It paused 2–3 minutes between each call.

HABITAT: This species is found along rocky montane rainforest streams on Mt Lewis, N. Queensland, at an elevation of 1200 m above sea level.

DISTRIBUTION: At present it is only found on the SW. slope of Mt Lewis, N. Queensland.

REMARKS: Unlike the other three species there is only slight sexual difference in regard to the SV length.

ETYMOLOGY: The specific name is derived from the Greek prefix *rheos*, meaning stream, and the Greek word *philos* meaning love or fond of, with reference to the creek-dwelling habit.

DISCUSSION

Species of *Taudactylus* possess some highly adaptive features amongst the Australo-papuan leptodactylids: adults with a distinct digital disc which is grooved longitudinally; T-shaped terminal phalanx; tadpoles toothless with a broad expanded labium surrounded completely by a single row of labial papillae in *T. diurnus* and *T. eungellensis*, while in *T. acutirostris* the tadpoles are toothed, and the row of labial papillae surrounding the expanded labium is interrupted anteriorly. All these known tadpoles possess lateral line organs around the eyes extending posteriorly behind the eyes and branching into two, one leading toward the anal region and another extending along the muscular tail. This structure is apparently only found in this genus amongst the known Australo-papuan leptodactylid tadpoles.

This genus shares numerous features with various myobatrachine members, not only the adult structures, e.g. cricoid does not form a complete ring ventrally, alary process of hyoid apparatus broad and wing-like, M. levator mandibulae subexternus absent, nervus mandibulae lies lateral to M. levator mandibulae externus, etc., but also the tooth row formula in *T. acutirostris* tadpoles resembles most myobatrachine species. Furthermore the tapping call of members of *Taudactylus* resembles *Crinia rosea*. Because *Taudactylus* shares numerous structures with members of Myobatrachinae, it undoubtedly belongs to this group; this concurs with Lynch's (1971, p. 97) conclusion. Amongst the Myobatrachinae, *Taudactylus* appears to be closely related to *Crinia*, sharing the presence of maxillary teeth; absence of outer metatarsal tubercle is shared with *Crinia leai*, *C. rosea*, *C. victoriana*, *C. haswelli*, *C. laevis* and *C. darlingtoni*; small occipital condyles and relatively long zygomatic rami of squamosal are shared with *Crinia* and *Pseudophryne*. The fringed toes of *Taudactylus* are shared with *Crinia haswelli*, *C. riparia*, and *C. sloanei*. Testes of mature *Taudactylus* males are dark brown to black and these are shared with all members of *Kyarranus* and *Crinia*.

In view of the above data it appears that *Taudactylus* most likely was derived from a *Crinia*-like ancestor which had adapted to survive on montane rainforest streams along the Great Dividing Range of eastern Australia.

The early divergence of members of the genus *Taudactylus* is supported by the morphological specialization in adults as well as in tadpoles, the restricted habitat preference in rainforest, and the diurnal habits. *Taudactylus*, with other relict frog species in eastern Australia, occupies disjunct high mountain areas, where relict plant communities e.g. Antarctic beech forest, also occur. Adaptive specialization of relict frogs are expressed in various ways, e.g. terrestrial egg masses and sucker mouth tadpoles in *Mixophyes fasciolatus*, *M. iteratus*, *M. balbus*, and *M. schevilli* (Moore, 1961; Straughan, 1966); development of tadpoles in small pockets of temporary water bodies and tadpole cannibalism in *Lechriodus fletcheri* (Moore, 1961); terrestrial nest and direct development in *Kyarranus loveridgei* (Moore, 1961); and direct development in brood pouches in *Crinia darlingtoni* (Straughan and Main, 1966).

Straughan and Main (1966) discussed briefly the peculiar distribution of New Guinean frogs, where they are restricted to rainforest of north Queensland. Main (1968) has presented a logical explanation of this distribution pattern, and suggested that the northern rainforests which have many New Guinean elements are separated by a wide arid low country from the southern rainforest. Tate (1952) argued that invasion of New Guinean forms appears as a consequence of lower sea level during the pleistocene period, which led to a land mass connecting between North Australia and New Guinea. Straughan and Main (1966) and Main (1968) have suggested that the New Guinean elements had invaded north Queensland recently, probably during the pleistocene, and that they never had crossed the low arid belt between Townsville and Rockhampton. Furthermore they suggested that genera with disjunct north and south rainforest forms (*Mixophyes*, *Lechriodus* and *Taudactylus*) must have spread along the Great Dividing Range prior to the development of the arid belt. Main (1968) added that if the dry belt developed in the pleistocene then *Mixophyes*, *Lechriodus* and *Taudactylus* must have a continuous distribution in the tertiary (probably pliocene). The presence of *Taudactylus eungellensis* in the isolated montane rainforest in Eungella-Finch Hatton area near Mackay, and *T. diurnus* from Kondallilla, SE. Queensland, which were found recently by the senior author, substantiate that at one time this genus had a continuous distribution along the Great Dividing Range.

Taudactylus diurnus is more closely related to *T. eungellensis* than to the two other species sharing numerous derived characters, e.g. broad digital discs, broad toe fingers, absence of omosternum, absence of subarticular tubercles of fingers, absence of vocal sac in males, absence of labial tooth rows and uninterrupted labial papillae in tadpoles. On the other hand *T. acutirostris* and *T. rheophilus* are more closely related to each other than to the two other species, and share some characters which are not shared with *T. diurnus* and *T. eungellensis*, e.g. presence of omosternum, narrow digital discs, narrow toe fringes, presence of subarticular tubercles of fingers, and the presence of a vocal sac in males. *T. acutirostris* tadpoles with labial tooth rows and interrupted labial papillae row are different from those of *T. diurnus* and *T. eungellensis*.

With the exception of the odd occurrence of the questionable *T. acutirostris* from Mundubbera reported by Parker (1940), the divergence of *diurnus-eungellensis* versus *acutirostris-rheophilus* supports the effect of the arid belt which lies somewhere between Rockhampton and Townsville.

Because *T. diurnus* and *T. eungellensis* possess more numerous derived characters than *T. acutirostris* and *T. rheophilus*, it is highly probable the former pair were derived from an *acutirostris-rheophilus* like ancestor. Because *T. eungellensis* tadpoles still possess stronger ridges on lower labium which resemble degenerated labial tooth rows, and because the males have normal loud calls, it is highly probable that this form gives rise to the more specialized *T. diurnus*. The relationship between *T. acutirostris* and *T. rheophilus*, however, is not clear. Finally, one could speculate:

- (1) That either *T. acutirostris* or *T. rheophilus* could be expected in various other isolated mountain rainforest or wet sclerophyll forest along the Great Dividing Range north of Townsville.
- (2) That *T. diurnus* and/or *T. eungellensis* may occur in other montane rainforest or wet sclerophyll forest along the Great Dividing Range between Mackay and Macpherson Range in SE. Queensland.
- (3) That the occurrence of *Taudactylus acutirostris* (*Crinia acutirostris* sensu Parker) in Mundubbera, SE. Queensland (Parker, 1940) is questionable.

Probably *Taudactylus* differentiated from *Crinia*-like ancestors during the Tertiary, about the same period *Crinia darlingtoni* differentiated as suggested by Straughan and Main (1966).

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PLATE 29

Taudactylus rheophilus, QM J22428, Mt Lewis, N. Queensland

